EXHIBIT A

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

MILLIMAN, INC., MILLIMAN SOLUTIONS, LLC, and VIGILYTICS LLC, Plaintiffs, vs. GRADIENT A.I. CORP., STANFORD A. SMITH, and SAMUEL CHASE PETTUS, Defendants.	)	Civil Action No. 1:21-cv-10865-NMG

DECLARATION OF DR. AVIEL D. RUBIN

I, Aviel D. Rubin, Ph.D., hereby declare as follows:

Section 1. Introduction

1.1 I have been retained by counsel for Milliman, Inc. and Milliman Solutions, LLC (collectively, "Milliman") to assist Plaintiffs, Milliman and Vigilytics LLC, as a technical expert for the proceeding identified above. I submit this declaration in support of Plaintiffs' motion to compel compliance with the Court's automatic patent disclosures.

1.2 I understand that Plaintiffs assert the Defendant Gradient A.I. Corp. (hereinafter, "Gradient") infringes six (6) U.S. patents in this action, namely: Patent No. 9,118,641 (hereinafter, "'641 Patent"); Patent No. 9,323,892; Patent No. 9,665,685; Patent No. 9,965,651; Patent No. 10,109,375; and Patent No. 10,886,012 (collectively, "Asserted Patents"). The Asserted Patents relate generally to systems for accessing individual protected health information using tokenization to allow the transmission of medical information without implicating patient privacy or violating relevant privacy laws.

Section 2. Background and Qualifications

2.1 I have more than 25 years of experience in field of computer science, and specifically, computer security. A copy of my curriculum vitae is attached as Appendix A hereto.

2.2 I received my Ph.D. in Computer Science and Engineering from the University of Michigan, Ann Arbor in 1994, with a specialty in computer security and cryptographic protocols. My thesis was titled "Nonmonotonic Cryptographic Protocols" and concerned authentication in long-running networking operations.

2.3 I am currently employed as Professor of Computer Science at Johns Hopkins University, where I perform research, teach graduate courses in computer science and related subjects, and supervise the research of Ph.D. candidates and other students. Courses I have taught include Security and Privacy in Computing and Advanced Topics in Computer Security. I am also the Technical Director of the Johns Hopkins University Information Security Institute, the University's focal point for research and education in information security, assurance, and privacy. The University, through the Information Security Institute's leadership, has been designated as a Center of Academic Excellence in Information Assurance by the National Security Agency and leading experts in the field. The focus of my work over my career has been computer security, and my current research concentrates on systems and networking security, with special attention to software and network security in the Internet context.

2.4 After receiving my Ph.D., I began working at Bellcore in its Cryptography and Network Security Research Group from 1994 to 1996. During this period I focused my work on computer security. While at Bellcore, I published an article titled "Blocking Java Applets at the Firewall" about the security challenges of dealing with JAVA applets and firewalls, and a system

that we built to overcome those challenges.

2.5 In 1997, I moved to AT&T Labs, Secure Systems Research Department, where I continued to focus on computer security. From 1995 through 1999, in addition to my work in industry, I served as Adjunct Professor at New York University, where I taught undergraduate classes on computer, network and Internet security issues.

2.6 I stayed in my position at AT&T until 2003, when I left to accept a full time academic position at Johns Hopkins University. The University promoted me to full professor with tenure in April, 2004.

2.7 I serve, or have served, on a number of technical and editorial advisory boards. I served on the Editorial and Advisory Board for the International Journal of Information and Computer Security. I also served on the Editorial Board for the Journal of Privacy Technology. I have been Associate Editor of IEEE Security and Privacy Magazine, and served as Associate Editor of ACM Transactions on Internet Technology. I have served as an Associate Editor of the journal Communications of the ACM. I was an Advisory Board Member of Springer's Information Security and Cryptography Book Series. I have served in the past as a member of the DARPA Information Science and Technology Study Group, a member of the Government Infosec Science and Technology Study Group of Malicious Code, a member of the AT&T Intellectual Property Review Team, Associate Editor of Electronic Commerce Research Journal, Co-editor of the Electronic Newsletter of the IEEE Technical Committee on Security and Privacy, a member of the board of directors of the USENIX Association, the leading academic computing systems society, and a member of the editorial board of the Bellcore Security Update Newsletter.

2.8 I have spoken on information security and electronic privacy issues at more than

50 seminars and symposia. I presented keynote addresses on the topics "Security of Electronic Voting" at Computer Security 2004 Mexico in Mexico City in May 2004; "Electronic Voting" to the Secure Trusted Systems Consortium 5th Annual Symposium in Washington DC in December 2003; "Security Problems on the Web" to the AT&T EUA Customer conference in March, 2000; and "Security on the Internet" to the AT&T Security Workshop in June 1997. I also presented a talk about hacking devices at the TEDx conference in October, 2011.

2.9 I was founder and President of Independent Security Evaluators (ISE), a computer security consulting firm, from 2005-2011. In that capacity, I guided ISE through the qualification as an independent testing lab for Consumer Union, which produces Consumer Reports magazine. As an independent testing lab for Consumer Union, I managed an annual project where we tested all of the popular anti-virus products. Our results were published in Consumer Reports each year for three consecutive years.

2.10 I am currently the founder and managing partner of Harbor Labs, a software and networking consulting firm.

2.11 I am a named inventor on ten United States patents, all in the information security area. The patent numbers and titles as well as my co-inventors are listed on the attached curriculum vitae. In March, 2004, I was asked by the Federal Trade Commission to submit a report commenting on the viability and usefulness of a national do not email registry. I submitted my report entitled "A Report to the Federal Trade Commission on Responses to Their Request For Information on Establishing a National Do Not E-mail Registry" on May 10, 2004.

2.12 I have also testified before Congress regarding the security issues with electronic voting machines and in the United States Senate on the issue of censorship. I also testified in Congress on November 19, 2013 about security issues related to the government's

Healthcare.gov web site.

2.13 I am author or co-author of five books regarding information security issues: Brave New Ballot, Random House, 2006; Firewalls and Internet Security (second edition), Addison Wesley, 2003; White-Hat Security Arsenal, Addison Wesley, 2001; Peer-to-Peer, O'Reilly, 2001; and Web Security Sourcebook, John Wiley & Sons, 1997. I am also the author of numerous journal and conference publications.

2.14 Additional details of my education and employment history, recent professional service, patents, publications, and other testimony are set forth in my current curriculum vitae, attached to this declaration as Appendix A.

2.15 As is apparent from the above description, virtually my entire professional career has been dedicated to issues relating to computer networks, particularly with respect to security.

Section 3. Defendants' Disclosure of Technical Documents About the Accused System

3.1 I have reviewed Plaintiffs' Infringement Claim Charts for the Asserted Patents served with Plaintiffs' Preliminary Patent-Related Disclosures on July 21, 2022. These claim charts identify as the "Accused Instrumentalities" Gradient's "health underwriting models, including but not limited to the SAIL Predictive Underwriting Model, and any other health underwriting model of Gradient, where Gradient provides a predictive risk score, such as, but not limited to, the 'Group Risk Score' …."

3.2 To that end, I understand that Gradient's website advertises its "SAIL™ group health underwriting solution" that "evaluates the potential cost of each submission and provides predictions that clients can incorporate into automated underwriting processes or use internally for underwriting and pricing decision support." *See* Appendix B (www.gradientai.com/ai-underwriting#RiskRanking). According to the website, "SAIL™ uses anonymized prescription

and medical claims data on the submitted population to inform its predictions."

3.3 I understand that Gradient has to date produced only six documents that are marginally related to the operation of the Accused Instrumentalities. Four of six documents produced include: [redacted] The other two documents are [redacted]" This handful of documents is not sufficient to show the composition, operation, construction, and performance of the Accused Instrumentalities or its challenged elements.

3.4 To demonstrate this point, as an example, claim 7 of the '641 Patent is directed to a system with components that "provid[es] healthcare information to report the characteristics of [a] group composed of multiple individuals absent authorization at any time from the individuals in the group of individuals to provide the requested healthcare information." Claim 7 recites "an encryption server … for producing a token for each individual included in a group composed of multiple individuals identified in a request for healthcare information that characterizes the group, wherein the identity of the individuals in the group is unattainable from the tokens, each token being associated with a corresponding token in a set of de-identified healthcare data, and each token in the set of de-identified healthcare data being associated with healthcare data for a corresponding individual …."

3.5 [redacted]

[redacted]

[redacted]

[redacted]

3.10 The information about [redacted] is relevant to assessing whether the Asserted Patents are infringed. For example, claim 7 of the '641 Patent recites "providing produced healthcare information to report characteristics of the group composed of multiple individuals absent authorization at any time from the individuals in the group of individuals to provide the requested healthcare information."

3.11 The information about [redacted] is relevant to assessing whether the Asserted Patents are infringed. For example, claim 7 of the '641 Patent recites a matching operation where tokens generated by the encryption server are "associated with a corresponding token in a set of de-identified healthcare data, and each token in the set of de-identified healthcare data being associated with healthcare data for a corresponding individual" where the tokens produced by the encryption server "and the tokens in the set of de-identified data are similarly encrypted …."

3.12 Based on my experience in computer science and network security, I would expect that a company that provides a "group health underwriting solution," i.e., SAIL, that "evaluates the potential cost of each submission and provides predictions that clients can incorporate into automated underwriting processes or use internally for underwriting and pricing decision support," using "anonymized prescription and medical claims data on the submitted population to inform its predictions," (quoting from Gradient's website at Appendix B) would have more complete documentation about how the SAIL solution operates to provide the "predictions" and how it uses "anonymized prescription and medical claims data on the submitted population to inform its predictions." In my experience, such other documentation

that a company like Gradient is likely to have about a software-solution like Gradient's SAIL solution includes: [redacted]

3.13 Defendants produced no source code for the Accused Instrumentalities. Source code is computer code written using a human readable programming language that is compiled or assembled into an executable computer program. Based on my numerous years of experience in computer science, I would expect Defendants to possess source code related to, among other things: [redacted] Such source code would be relevant to assessing whether the Accused Instrumentalities infringe the Asserted Patents, including additional claims not yet asserted, given the elements of the asserted claims thereof.

Section 4. Concluding Remarks

4.1 I am a U.S. citizen, a resident of the United States, over 18 years of age, and mentally competent to make this declaration. I have personal knowledge of the facts stated in this declaration and could testify competently to them if asked to do so.

4.2 I am being compensated in this matter for my time at a rate of $850 per hour.

4.3 I have no financial interest in the outcome of any litigation involving the Asserted Patents.

4.4 I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 16th day of September, 2022 in Baltimore, MD.

Aviel D. Rubin

APPENDIX A

Avi Rubin's Vita

Academic Degrees

- 1994, Ph.D., Computer Science and Engineering, University of Michigan, Ann Arbor
- 1991, M.S.E., Computer Science and Engineering, University of Michigan, Ann Arbor
- 1989, B.S., Computer Science (Honors), University of Michigan, Ann Arbor

Academic Appointments

- April, 2004 - present
  Professor, Johns Hopkins University

- August, 2010 - July, 2011
  Visiting Research Professor, Fulbright Scholar, Tel Aviv University, Israel

- January, 2003 - April, 2004
  Associate Professor, Johns Hopkins University

- January, 2003 - present
  Technical Director, Johns Hopkins University Information Security Institute

- 2006 - 2010
  Director and Principal Investigator (PI), National Science Foundation's ACCURATE Center

- 1995 - 1999
  Adjunct Professor, New York University
  - *Internet and Web Security* Spring, 1999 (with Dave Kormann)

- *Privacy in Networks: Attacks and Defenses* Spring, 1998 (with Dave Kormann and Mike Reiter)
- *Design and Analysis of Cryptographic Protocols* Fall, 1996 & Spring, 1997 (with Matt Franklin)
- *Cryptography and Computer Security* Fall, 1995 & Spring, 1996

- Summer, 1999
  Visiting Professor, École Normale Supérieure, Paris, France

- 1988 - 1993
  Teaching Assistant, University of Michigan
  - 1993 *Intro. to Cryptography*
  - 1992 *Assembler Language Programming*
  - 1991 *Software Engineering*
  - 1990 *IVHS Seminar*
  - 1989-1990 **Head TA**, *Intro. to Computer Science*
  - 1988-1989 *Intro. to Computer Science*

- **Doctoral Committees**
  - **Doctoral Thesis Advisor:** Logan Kostick:, JHU
  - **Doctoral Thesis Advisor:** Atheer Almogbil, JHU
  - **Doctoral Thesis Advisor:** Tushar Jois, JHU
  - **Doctoral Thesis Advisor:** Jeff Chavis, JHU (May, 2021)
  - **Doctoral Thesis Advisor:** Gabe Kaptchuk, JHU (May, 2020)
  - **Dissertation Committee:** Thomas Tantillo, JHU (September, 2018)
  - **Doctoral Thesis Advisor:** Paul Martin, JHU (February, 2016)
  - **Doctoral Thesis Advisor:** Michael Rushanan, JHU (May, 2016)
  - **Doctoral Thesis Advisor:** Ayo Akinyele, JHU (December, 2013)
  - **Doctoral Thesis Advisor:** Matthew Pagano, JHU (August, 2013)
  - **Doctoral Thesis Advisor:** Ryan Gardner, JHU (August, 2009)
  - **Doctoral Thesis Advisor:** Sam Small, JHU (May, 2009)
  - **Doctoral Thesis Advisor:** Sujata Doshi, JHU (May, 2009)
  - **Doctoral Thesis Advisor:** Joshua Mason, JHU (June, 2009).
  - **Dissertation Committee:** J. Alex Halderman, Princeton University (May, 2009).
  - **Dissertation Committee:** Sophie Qiu (May, 2007).
  - **Doctoral Thesis Advisor:** Adam Stubblefield (April, 2005).
  - **Dissertation Committee:** Kevin FU, MIT (February, 2005).
  - **Dissertation Committee:** Robert Fischer, Harvard University (June, 2003).
  - **Dissertation Committee:** Marc Waldman, New York University, (April, 2003).
  - **Dissertation Committee:** Patrick McDaniel, University of Michigan (September, 2001).
  - **Doctoral Thesis Advisor:** Fabian Monrose, New York University (April, 1999).
  - **Dissertation Committee:** Mike Just, Carleton University (November, 1998).
  - **Dissertation Committee:** Trent Jaeger, University of Michigan (October, 1996).

Industry Experience

- 2011 - present
  Harbor Labs, Managing Member
- 2005 - 2011
  Independent Security Evaulators, Founder & President
- 1997 - 2002
  AT&T Labs - Research, Secure Systems Research Department
- 1994 - 1996
  Bellcore, Cryptography and Network Security Research Group

- Summer, 1990
  Great Lakes Software Co., *Programmer*, Howell, MI
- Summer, 1989
  IBM, *Programmer*, Meyers Corners Lab, Poughkeepsie, NY

Books

- Aviel D. Rubin, *Brave New Ballot*, Random House, (September, 2006).
- William R. Cheswick, Steven M. Bellovin and Aviel D. Rubin, *Firewalls and Internet Security: Repelling the Wily Hacker (2e)*, Addison Wesley Publishing Company, Inc., (February, 2003).
- **Chapter 4**, *Communications Policy and Information Technology: Promises, Problems, Prospects*, MIT Press, Lorrie Faith Cranor and Shane Mitchell Greenstein, eds., (2002).
- Aviel D. Rubin, *White-hat Security Arsenal*, Addison Wesley Publishing Company, Inc., (June, 2001).
- **Chapter 8**, *Publius* and **Chapter 14**, *Trust in Distributed Systems*, Marc Waldman, Lorrie Faith Cranor, and Aviel D. Rubin, *Peer-to-Peer*, O'Reilly & Associates, Inc., (February, 2001).
- Aviel D. Rubin, Daniel Geer, Marcus J. Ranum, *Web Security Sourcebook*, John Wiley & Sons, Inc , (June, 1997).
- **Ph.D. dissertation:** *Nonmonotonic Cryptographic Protocols* (ps.gz, pdf), University of Michigan, Ann Arbor (April, 1994).

Refereed Journal Publications

- David Kotz, Kevin Fu, Carl Gunter, Avi Rubin, *Security for Mobile and Cloud Frontiers in Healthcare,* Communications of the ACM (July, 2015).
- Ayo Akinyele, Christina Garman, Matthew D. Green, Ian Miers, Matthew Pagano, Aviel D. Rubin, Michael Rushanan, *Charm: A Framework for Rapidly Prototyping Cryptosystems,* Journal of Cryptographic Engineering (JCEN), (January, 2013).
- Ryan Gardner, Sujata Garera, and Aviel D. Rubin, *Detecting Code Alteration by Creating a Temporary Memory Bottleneck*, IEEE Transactions on Information Forensics and Security: Special Issue on Electronic Voting, (December, 2009).
- Matt Blaze, John Ioannidis, Angelos D. Keromytis, Tal Malkin, Avi Rubin, *Anonymity in Wireless Broadcast Networks*, International Journal of Network Security (IJNS), (January, 2008).
- Stephen Bono, Aviel Rubin, Adam Stubblefield, and Matthew Green, *Security Through Legality*, Communications of the ACM (June, 2006).
- Adam Stubblefield, Dan S. Wallach, and Aviel D. Rubin, *Managing the Performance Impact of Web Security*, Electronic Commerce Research Journal, February, 2005.
- David Jefferson, Aviel D. Rubin, Barbara Simons, David Wagner, *Analyzing Internet Voting Security*, Communications of the ACM (October, 2004).
- Simon Byers, Aviel D. Rubin, and David Kormann, *Defending Against an Internet-based Attack on the Physical World*, ACM Transactions on Internet Technology (TOIT), August, 2004.
- Adam Stubblefield, John Ioannidis, and Aviel D. Rubin, *A Key Recovery Attack on the 802.11b Wired Equivalent Privacy Protocol (WEP)* (pdf), ACM Transactions on Information and System Security, May, 2004.
- Aviel D. Rubin, *Security Considerations for Remote Electronic Voting*, Communications of the ACM (December, 2002).
- Marc Waldman, Aviel D. Rubin, and Lorrie F. Cranor, *The Architecture of Robust Publishing Systems*, ACM Transactions on Internet Technology (TOIT), (November, 2001).

- David P. Kormann and Aviel D. Rubin, *Risks of the Passport Single Signon Protocol*, Computer Networks, (July, 2000).
- Christian Gilmore, David P. Kormann, and Aviel D. Rubin, *Secure Remote Access to an Internal Web Server*, IEEE Network, (November, 1999).
- Fabian Monrose and Aviel D. Rubin, *Keystroke Dynamics as a Biometric for Authentication*, (pdf) Future Generation Computer Systems, (March, 2000).
- Michael K. Reiter and Aviel D. Rubin, *Anonymity Loves Company: Anonymous Web Transactions with Crowds* (ps.gz, pdf) Communications of the ACM (February, 1999).
- Aviel D. Rubin and Daniel E. Geer, Jr., *Mobile Code Security* (ps.gz, pdf), IEEE Internet Computing (November/December, 1998).
- Aviel D. Rubin and Daniel E. Geer, Jr., *A Survey of Web Security*, IEEE Computer, (September, 1998).
- Michael K. Reiter and Aviel D. Rubin, *Crowds: Anonymity for Web Transactions* (ps.gz, pdf), ACM Transactions on Information and System Security, (June, 1998).
- Aviel D. Rubin, *An Experience Teaching a Graduate Course in Cryptography* (ps, pdf), Cryptologia (April, 1997).
- Aviel D. Rubin, *Extending NCP for public Key Protocols*, Mobile Networks and Applications (ACM/Balzer), 2(3) (April, 1997).
- Aviel D. Rubin, *Independent One-Time Passwords*, (ps.gz, pdf) USENIX Journal of Computer Systems (February, 1996).
- Aviel D. Rubin, *Secure Distribution of Documents in a Hostile Environment*, Computer Communications (June, 1995).

Refereed Conference Publications

- James Cervini & Aviel D. Rubin, *Don't Drink the Cyber: Extrapolating the Possibilities of Oldsmar's Water Treatment Cyberattack*, ICCWS 17th International Conference on Cyber Warfare and Security, (July, 2022).
- Gabriel Kaptchuk, Tushar Jois, Matthew Green, Aviel Rubin, *Make Steganography Great Again — Before It's Too Late*, Real World Crypto 2022, (April, 2022).
- James Cervini, Daniel Muller, Alexander Beall, Joseph Maurio, Aviel Rubin & Lanier Watkins, *A Backfit Approach for Trusted Virtualization-Based Programmable Logic Controller Resilience*, Sixteenth Annual IFIP WG 11.10 International Conference on Critical Infrastructure Protection, (March, 2022).
- Hedin Beattie , Lanier Watkins, William H. Robinson, Aviel Rubin, Shari Watkins, *Measuring and Mitigating Bias in AI-Chatbots*, 2022 IEEE International Conference on Assured Autonomy (ICAA'22), (March, 2022).
- Random Gwinn, Mark Matties, Aviel D. Rubin, *Wavelet Selection and Employment for Side-Channel Disassembly*, IEEE International Conference on Physical Assurance and Inspection of Electronics (PAINE), (December, 2021).
- Karl A Siil , Aviel D. Rubin , Matthew C. Elder, Anton T Dahbura, Matthew Green, Lanier Watkins, *Cost-Effective Mission Assurance Engineering Through Simulation*, The 2021 International Conference on Internet of Things and Intelligence Systems (IoTaIS'21), (November, 2021).
- Gabriel Kaptchuk, Tushar Jois, Matthew Green, Aviel Rubin, *Meteor: Cryptographically Secure Steganography for Realistic Distributions*, 28th ACM Conference on Computer and Communications Security (CCS '21), (November, 2021).
- James Schaffter, Aviel Rubin and Lanier Watkins, *A Containerization-Based Backfit Approach for Industrial Control System Resiliency*, SafeThings '21 Workshop, (May, 2021).
- Tushar Jois, Claudia Moncaliano, Khir Henderson, Aviel D. Rubin, *WDPKR: Wireless Device Profiling Kit and Reconnaissance*, 2021 Hot Topics in the Science of Security (HotSoS) Symposium (April, 2021) .
- Lanier Watkins, Chang-Hao Cho, John Hurley, Aviel D. Rubin, *Collaborative Global Impact Cloud Computing Risk Assessment Framework*, International IoT, Electronics and Mechatronics Conference (IEMTRONICS '21), (April, 2021).
- Jeffrey S. Chavis, Malcom Doster, Michelle Feng, Syeda Zeeshan, Samantha Fu, Elizabeth Aguirre, Antonio Davila, Kofi Nyarko, Aaron Kunz, Tracy Herriotts, Daniel Syed, Lanier Watkins, Anna Buczak, Aviel Rubin, *A Voice Assistant for IoT Cybersecurity*, Integrated STEM Education Conference (ISEC '21), (March, 2021).

- Lanier Watkins, Danzel Hamilton, Kevin Kornegay, Aviel Rubin, *Triaging Autonomous Drone Faults by Simultaneously Assuring Autonomy and Security in Autonomous Drones*, 55th Annual Conference on Information Sciences and Systems (CISS '21), (March, 2021).
- Lanier Watkins, James Ballard, Kevin Hamilton, William H. Robinson, Aviel Rubin, Cleon Davis, *Bio-Inspired, Host-based Firewall (Refereed WIP paper)*, 23rd IEEE International Conference on Computational Science and Engineering (CSE), (December, 2020).
- Lanier Watkins, Yue Yu, Sifan Li, William H. Robinson, Aviel D. Rubin, *Using Deep Learning to Identify Security Risks of Personal Mobile Devices in Enterprise Networks*, The 11th IEEE Annual Ubiquitous Computing, Electronics, and Mobile Communications Conference (UEMCON), (October, 2020).
- Lanier Watkins, Kevin D. Fairbanks, Chengyu Li, Mengdi Yang, William H. Robinson, Aviel D. Rubin, *A Black Box Approach to Inferring Characterizing, and Breaking Native Device Tracking Autonomy,* The 11th IEEE Annual Ubiquitous Computing, Electronics, and Mobile Communications Conference (UEMCON), (October, 2020).
- Karl Siil, Aviel Rubin, Matthew Elder, Anton Dahbura, Matthew Green, Lanier Watkins, *Mission Assurance for Autonomous Undersea Vehicles,* IEEE Workshop on Assured Autonomous Systems (WAAS), (May, 2020).
- Jeffrey Chavis, Aaron Kunz, Lanier Watkins, Anna Buczak, Aviel Rubin, *A Capability for Autonomous IoT System Security: Pushing IoT Assurance to the Edge,* IEEE Workshop on Assured Autonomous Systems (WAAS), (May, 2020).
- Lanier Watkins, Shane Sartalamacchia, Richard Bradt, Karan Dhareshwar, Harsimar Bagga, William H. Robinson, Aviel Rubin, *Defending Against Consumer Drone Privacy Attacks: A Blueprint For A Counter Autonomous Drone Tool,* ISOC Workshop on Decentralized IoT Systems and Security (DISS 2020), (February, 2020).
- Adrian Cartagena, Gerald Rimmer, Thomas Van Dalsen, Lanier Watkins, William H. Robinson, Aviel D. Rubin, *Privacy Violating Opensource Intelligence Threat Evaluation Framework: A Security Assessment Framework for Critical Infrastructure Owners*, 10th Annual Computing and Communications Workshop and Confefence (IEEE CCWC 2020), (January, 2020).
- Jeffrey Chavis, Lanier Watkins, Anna Buczak, Aviel D. Rubin, *Connected Home Automated Security Monitor (CHASM): Protecting IoT Through Application of Machine Learning*, 10th Annual Computing and Communications Workshop and Confefence (IEEE CCWC 2020), (January, 2020).
- Lanier Watkins, Shreya Aggarwal, Omotola Akeredolu, William H. Robinson and Aviel D. Rubin, *Tattle Tail Security: An Intrusion Detection System for Medical Body Area Networks*, Workshop on Decentralized IoT Systems and Security (DISS '19), (February, 2019).
- Lanier Watkins, Juan Ramon, Gaetano Snow, Jessica Vallejo, William H. Robinson, Aviel D. Rubin, Joshua Ciocco, Felix Jedrzejewski, Jinglun Liu, Chengyu Li, *Exploiting Multi-Vendor Vulnerabilities as Back-Doors to Counter the Threat of Rogue Small Unmanned Aerial Systems* , ACM Workshop on Mobile IoT Sensing, Security, and Privacy (Mobile IoT SSP '18), (June, 2018).
- Paul D. Martin, David Russel, Malek Ben Salem, Stephen Checkoway, Aviel D. Rubin, S*entinel: Secure Mode Profiling and Enforcement for Embedded Systems*, Proc. ACM/IEEE International Conference on Internet-of-Things Design and Implementation, (April, 2018).
- Gabriel Kaptchuk, Matthew D. Green and Aviel D. Rubin, *Outsourcing Medical Dataset Analysis: A Possible Solution*, Financial Cryptography Conference, (April, 2017).
- Michael Rushanan, David Russell and Aviel D. Rubin, *MalloryWorker: Stealthy Computation and Covert Channels using Web Workers,* Proceedings of the 12th International Workshop on Security and Trust Management, (September, 2016).
- Paul Martin, Michael Rushanan, Thomas Tantillo, Christoph Lehmann and Aviel Rubin, *Applications of Secure Location Sensing in Healthcare,* Proceedings of the 7th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics, (October, 2016).
- Gabriel Kaptchuk and Aviel D. Rubin, *A Practical Implementation of a Multi-Device Split Application for Protecting Online Poker* , Proceedings of the 15th Annual Security Conference, (March, 2016).
- Aviel D. Rubin, *Taking Two-Factor to the Next Level: Protecting Online Poker, Banking, Healthcare and Other Applications*, Proceedings of the 2014 Annual Computer Security Applications Conference, Invited Keynote Essay, (December, 2014).
- Michael Rushanan, Aviel D. Rubin, Denis Foo Kune, Colleen M. Swanson, *Security and Privacy in Implantable Medical Devices and Body Area Networks*, IEEE Symposium on Security and Privacy - SoK Track (May, 2014).
- Christina Garman, Matthew Green, Ian Miers, Aviel D. Rubin, *Rational Zero: Economic Security for Zerocoin with Everlasting Anonymity,* 1st Workshop on Bitcoin Research (March, 2014).

- Paul Martin, Avi Rubin and Rafae Bhatti, *Enforcing Minimum Necessary Access in Healthcare Through Integrated Audit and Access Control,* Health Informatics Symposium at the ACM Conference on Bioinformatics, Computational Biology, and Biomedical Informatics, (September, 2013).
- Ian M. Miers, Christina Garman, Matthew D. Green, Aviel D. Rubin, *Zerocoin: Anonymous Distributed e-Cash from Bitcoin*, Proc. IEEE Symposium on Security and Privacy (May, 2013).
- Ian M. Miers, Matthew D. Green, Christoph U. Lehmann, Aviel D. Rubin, *Vis-à-Vis Cryptography: Private and Trustworthy In-Person Certifications*, In Proceedings of the 3rd USENIX/HealthSec Workshop, (August, 2012).
- Joseph A. Akinyele, Matthew W. Pagano, Matthew D. Green, Christoph U. Lehmann, Zachary N. J. Peterson and Aviel D. Rubin, *Securing Electronic Medical Records Using Attribute-Based Encryption On Mobile Devices*, ACM CCS Workshop on Security and Privacy in Smartphones and Mobile Devices, (October, 2011).
- Matthew D. Green, Aviel D. Rubin, *A Research Roadmap for Healthcare IT Security inspired by the PCAST Health Information Technology Report - 4 page Extended Abstract*, In Proceedings of the 2nd USENIX/HealthSec Workshop, (August, 2011).
- Ryan Gardner, Sujata Garera, Aviel D. Rubin, *Designing for Audit: A Voting Machine with a Tiny TCB*, Financial Cryptography Conference, (January , 2010).
- Ryan Gardner, Sujata Garera, Matthew W. Pagano, Matthew D. Green, Aviel D. Rubin, *Securing Medical Records on Smart Phones, Workshop on Security and Privacy in Medical and Home-Care Systems*, (November, 2009).
- Ryan Gardner, Sujata Garera, Aviel D. Rubin, *Coercion Resistant End-to-end Voting*, Financial Cryptography Conference, (February, 2009).
- Ryan Gardner, Sujata Garera, Anand Rajan, Carols Rozas, Aviel D. Rubin, Manoj Sastry, *Protecting Patient Records from Unwarranted Access*, Future of Trust in Computing, (July, 2008).
- Sujata Garera, Niels Provos, Monica Chew and Aviel D. Rubin, *A Framework for Detection and Measurement of Phishing Attacks*, 5th ACM Workshop on Recurring Malcode (WORM 2007), (November, 2007).
- Sujata Garera and Aviel D. Rubin, *An Independent Audit Framework for Software Dependent Voting Systems*, 14th ACM Conference on Computer and Communications Security, (November, 2007).
- Ryan Gardner, Sujata Garera, and Aviel D. Rubin, *On the Difficulty of Validating Voting Machine Software with Software*, In Proceedings of the 2nd USENIX/ACCURATE Electronic Voting Technology Workshop (EVT '07), (August, 2007).
- Sujata Doshi, Fabian Monrose, and Aviel D. Rubin, *Efficient Memory Bound Puzzles using Pattern Databases*, 4th International Conference on Applied Cryptography and Network Security (ACNS'06), (June, 2006).
- Sophie Qiu, Patrick McDaniel, Fabian Monrose, and Avi Rubin, *Characterizing Address Use Structure and Stability of Origin Advertisement in Interdomain Routing*, 11th IEEE Symposium on Computers and Communications, (June 2006).
- Zachary Peterson, Randal Burns, Joseph Herring, Adam Stubblefield, and Aviel D. Rubin, *Secure Deletion for a Versioning Filesystem* , Proc. USENIX Conference on File and Storage Technologies (FAST '05), (December, 2005).
- Stephen C. Bono, Matthew Green, Adam Stubblefield, Ari Juels, Aviel D. Rubin, Michael Szydlo, *Security Analysis of a Cryptographically-Enabled RFID Device* 14th USENIX Security Symposium, (August, 2005).
- Tadayoshi Kohno, Adam Stubblefield, Aviel D. Rubin, and Dan S. Wallach, *Analysis of an Electronic Voting System*, Proc. IEEE Symposium on Security and Privacy (May, 2004).
- Nathanael Paul, David Evans, Aviel D. Rubin and Dan Wallach, *Authentication for Remote Voting*, ACM Workshop on Human-Computer Interaction and Security Systems (April, 2003).
- Matt Blaze, John Ioannidis, Angelos D. Keromytis, Tal Malkin, and Aviel Rubin, *Protocols for Anonymity in Wireless Networks,* Proc. 11th International Workshop on Security Protocols (April, 2003).
- Geoffrey Goodell, William Aiello, Timothy Griffin, John Ioannidis, Patrick McDaniel, Aviel Rubin, *Working Around BGP: An Incremental Approach to Improving Security and Accuracy of Interdomain Routing* , Proc. ISOC Symposium on Network and Distributed System Security (February, 2003).
- Simon Byers, Aviel D. Rubin, David Kormann, *Defending Against an Internet-based Attack on the Physical World* (pdf), ACM Workshop on Privacy in the Electronic Society (November, 2002).
- Adam Stubblefield, John Ioannidis, and Aviel D. Rubin, *Using the Fluhrer, Mantin, and Shamir Attack to Break WEP*, Proc. ISOC Symposium on Network and Distributed System Security

(February, 2002).
- Aviel D. Rubin, *Security Considerations for Remote Electronic Voting*, 29th Research Conference on Communication, Information and Internet Policy (TPRC2001), (October, 2001).
- Aviel D. Rubin and Rebecca N. Wright, *Off-line generation of limited-use credit card numbers*, (ps.gz, pdf) Financial Cryptography Conference, (February, 2001).
- Marc Waldman, Aviel D. Rubin, and Lorrie F. Cranor, *Publius, A robust, tamper-evident and censorship-resistant web publishing system*, 9th USENIX Security Symposium, (August, 2000).
- David P. Kormann and Aviel D. Rubin, *Risks of the Passport Single Signon Protocol*, 9th International World Wide Web Conference, (May, 2000).
- Patrick McDaniel and Aviel D. Rubin, *A Response to "Can we Eliminate Certificate Revocation Lists?"*, (ps.gz, pdf), Financial Cryptography Conference, (February, 2000).
- William A. Aiello, Aviel D. Rubin, and Martin J. Strauss, *Using smartcards to secure a personalized gambling device* (ps.gz, pdf), 6th ACM Conference on Computer and Communications Security, (November, 1999).
- Ian Jermyn, Alain Mayer, Fabian Monrose, Michael K. Reiter, and Aviel D. Rubin, *The Design and Analysis of Graphical Passwords* (ps.gz, pdf) 8th USENIX Security Symposium, (August, 1999).
- Christian Gilmore, David Kormann, and Aviel D. Rubin, *Secure Remote Access to an Internal Web Server*, (ps.gz, pdf), Proc. ISOC Symposium on Network and Distributed System Security (February, 1999).
- Fabian Monrose, Peter Wykoff, and Aviel D. Rubin, *Distributed Execution with Remote Audit* (ps.gz, pdf), Proc. ISOC Symposium on Network and Distributed System Security (February, 1999).
- Dahlia Malkhi, Michael K. Reiter and Aviel D. Rubin, *Secure Execution of Java Applets using a Remote Playground* (ps, pdf) Proc. IEEE Symposium on Security and Privacy (May, 1998).
- Aviel D. Rubin, Dan Boneh, and Kevin Fu, *Revocation of Unread E-mail in an Untrusted Network* (ps.gz, pdf), Second Australasian Conference on Information Security and Privacy (July, 1997).
- Fabian Monrose and Aviel D. Rubin, *Authentication via Keystroke Dynamics* (ps, pdf), 4th ACM Conference on Computer and Communications Security (April, 1997).
- David M. Martin, Siviramakrishnan Rajagopalan, and Aviel D. Rubin, *Blocking Java Applets at the Firewall* (ps, pdf), Proc. ISOC Symposium on Network and Distributed System Security (February, 1997).
- Trent Jaeger, Aviel D. Rubin and Atul Prakash, *A System Architecture for Flexible Control of Downloaded Executable Content*, 5th International Workshop on Object-Orientation in Operating Systems (October, 1996).
- Trent Jaeger, Aviel D. Rubin and Atul Prakash, *Building Systems that Flexibly Control Downloaded Executable Content*, Proc. 6th USENIX Security Symposium (July, 1996).
- Victor Shoup and Aviel D. Rubin, *Session Key Distribution Using Smart Cards*, (ps, pdf), Proc. of Eurocrypt '96 (May, 1996).
- Trent Jaeger & Aviel D. Rubin, *Preserving Integrity in Remote File Location and Retrieval*, Proc. ISOC Symposium on Network and Distributed System Security (February, 1996).
- Aviel D. Rubin, *Extending NCP for Public Key Protocols*, Proc. IEEE 4th International Conference on Computer Communications and Networks (September, 1995).
- Aviel D. Rubin, *Pseudo-Random Functions for One-Time Passwords*, Proc. 5th USENIX UNIX Security Symposium (June, 1995).
- Aviel D. Rubin, *Trusted Distribution of Software Over the Internet*, Proc. ISOC Symposium on Network and Distributed System Security (February, 1995).
- Aviel D. Rubin & Peter Honeyman, *Nonmonotonic Cryptographic Protocols*, Proc. IEEE Computer Security Foundations Workshop VII (June, 1994).
- Aviel D. Rubin & Peter Honeyman, *Long Running Jobs in an Authenticated Environment*, Proc. 4th USENIX UNIX Security Symposium (October, 1993).

Patents

- Aviel D. Rubin, "Broadband Certified Mail", **US Patent Numbers 6,990,581**, (January 24, 2006) and **9,876,769**, (January 23, 2018).
- Aviel D. Rubin, Utilization of multiple devices to secure online transactions, **US Patent Number 9,064,376**, (June 23, 2015).
- Steven M. Bellovin, Thomas J. Killian, Bruce LaRose, Aviel D. Rubin, Norman L. Schryer, Method and apparatus for connection to virtual private networks for secure transactions, **US Patent Numbers 8,239,531**, (August 7, 2012) and **8,676,916** (March 18, 2014).
- Christian A. Gilmore, David P. Kormann, and Aviel D. Rubin, Method and apparatus for secure remote access to an internal web server, **US Patent Number 7,334,126**, (February 19, 2008).
- Aviel D. Rubin, "Method for secure remote backup", **US Patent Number 7,222,233**, (May 22, 2007).
- Frederick Douglis, Michael Rabinovich, Aviel D. Rubin, and Oliver Spatscheck, "Method for content distribution in a network supporting a security protocol", **US Patent Number 7,149,803**, (December 12, 2006).
- William A. Aiello, Steven M. Bellovin, Charles Robert Kalmanek, Jr., William T Marshal, and Aviel D. Rubin, "Method and apparatus for enhanced security in a broadband telephony network", **US Patent Number 7,035,410**, (April 25, 2006).
- William A. Aiello, Aviel D. Rubin, and Martin J. Strauss, "Using smartcards to enable probabilistic transaction on an untrusted device", **US Patent Number 6,496,808**, (December 17, 2002).
- Aviel D. Rubin and Victor J. Shoup, "Session Key Distribution Using Smart Cards", **US Patent Number 5,809,140**, (September 15, 1998).
- Aviel D. Rubin, "Method for the Secure Distribution of Electronic Files in a Distributed Environment", **US Patent Number 5,638,446**, (June 10, 1997).

Professional Activities

- **Board of Directors**
  - Director, Maryland Israel Development Center (MIDC), (2013 - 2018).
  - Director, USENIX Organization, elected by popular vote (2000 - 2004).

- **Editorial and Committees**
  - **Chair:** IEEE Security & Privacy Symposium Test of Time Awards Committee for 2008-2010 Conferences, May, 2020.
  - **Associate Editor:** IEEE Transactions on Information Forensics and Security (2009-2011).
  - **Associate Editor**: Communications of the ACM (CACM), 2009 - 2017.
  - **Guest Co-Editor:** IEEE Transactions on Information Forensics and Security: *Special Issue on Electronic Voting*, December 1, 2009.
  - **Guest Co-Editor:** IEEE Security & Privacy Magazine, *Special Issue on Electronic Voting*, October/November, 2007.
  - **Associate Editor:** IEEE Transactions on Software Engineering (2005-2006).
  - **Editorial and Advisory Board:** International Journal of Information and Computer Security (IJICS) (2004-2006).
  - **Guest Co-Editor:** IEEE Computer Networks, *Special Issue on Web Security*, January, 2005.
  - **Editorial Board:** Journal of Privacy Technology (2004-2006).
  - **Guest Co-Editor:** IEEE Security & Privacy Magazine, *Special Issue on Electronic Voting Security*, January/February, 2004.

- **Member:** Security Peer Review Group (SPRG) of the Federal Voting Assistance Program's (FVAP) Secure Electronic Registration and Voting Experiment (SERVE) Project, 2003-2004.
- **Member:** DARPA Information Science And Technology Study Group (2003-2006).
- **Associate Editor:** IEEE Security & Privacy Magazine (2003-present).
- **Guest Editor:** Communications of the ACM, *Special Issue on Wireless Networking Security*, May, 2003.
- **Associate Editor:** ACM Transactions on Internet Technology (2002-2005).
- **Executive Committee Member:** DIMACS Workshop Series with Special Focus on Network Security (2002-2004).
- **Advisory Board Member:** Information Security and Cryptography Book Series, Springer, 2001-2006.
- **Member:** Steering Group, ISOC Symposium on Network and Distributed System Security, 2001-2004.
- **Member:** Government Infosec Science and Technology Study Group on malicious code, 1999 - 2000.
- **Member:** *AT&T Internet Intellectual Property Review Team*, 1999 - 2001.
- **Associate Editor:** *Electronic Commerce Research Journal*, Baltzer Science Publishers, 1999 - 2002.
- **Co-Editor:** Electronic Newsletter of the IEEE Technical Committee on Security & Privacy, with Paul Syverson, 1998.
- **Editorial Board:** Bellcore Security Update Newsletter, 1995-1996.

- Conference Committees

- Program Committee member: NDSS Workshop: Innovative Secure IT Technologies Against COVID-19, San Diego, CA, February, 2020.
- Program Committee member: Financial Cryptography '15 Barbados, February, 2015.
- Program Committee member: USENIX HealthTech Workshop on Health Information Technologies (HealthTech ’15), August 11, 2015.
- **Program Co-chair:** (w/Eugene Vasserman) USENIX HealthTech Workshop on Health Information Technologies (HealthTech ’14), August 19, 2014.
- Program Committee member: 2nd USENIX Workshop on Health Security and Privacy (HealthSec '11), August 9, 2011.
- **Program Co-chair:** (w/Kevin Fu & Yoshi Kohno), 1st USENIX Workshop on Health Security and Privacy (HealthSec '10), August 10, 2010.
- Program Committee member: First Security and Privacy in Medical and Home-Care Systems Workshop (SPIMACS), Chicago, IL, November 13, 2009.
- Invited Talks Co-Coordinator: 17th USENIX Security Symposium, San Jose, CA, July 28 - August 1, 2008.
- **Program Co-chair:** (w/Patrick McDaniel): IEEE Symposium on Security and Privacy, Oakland, California, May 18-22, 2008.
- **Program Co-chair:** (w/Giovani Di Crescenzo): Financial Cryptography '06 Anguilla BWI, February, 2006.
- Program Committee member: IEEE Symposium on Security and Privacy, Oakland, California, May 9-12, 2004.
- Program Committee member: Financial Cryptography '04 Key West, Florida, February 9-12, 2004.
- Program Committee member: 2nd ACM SIGSAC Workshop on Privacy in the Electronic Society Washington D.C., October 30, 2003.
- Program Committee member: 10th ACM Conference on Computer and Communications Security, Washington D.C., October 27-30, 2003.
- Program Committee member: 8th European Symposium on Research in Computer Science (ESORICS), Norway, October 13-15, 2002.
- **Program Vice Chair:** Security and Privacy Track, The Twelfth International World Wide Web Conference, Budapest, Hungary, May 20-24, 2003.
- Program Committee member: IEEE Symposium on Security and Privacy, Oakland, California, May 11-14, 2003.

- Program Committee member: Workshop on Security and Assurance in Ad hoc Networks, Orlando, FL, January 28, 2003.
- Program Committee member: 4th International Conference on Information and Communications Security (ICICS), Kent Ridge Digital Labs (KRDL), Singapore December 9-12, 2002.
- Program Committee member: ACM SIGSAC Workshop on Privacy in the Electronic Society Washington D.C., November 21, 2002.
- Program Committee member: 9th ACM Conference on Computer and Communications Security, Washington D.C., November 17-21, 2002.
- Program Committee member: 5th International Conference on Electronic Commerce Research (ICECR-5), Montreal, Canada, October 23-27, 2002.
- Program Committee member: 2nd Symposium on Requirements Engineering for Information Security (SREIS), Raleigh, North Carolina, Oct 14-15, 2002.
- Program Committee member: 7th European Symposium on Research in Computer Science (ESORICS), Zurich, Switzerland, October 14-16, 2002.
- Program Committee member: 11th USENIX Security Symposium, San Francisco, Ca, August 5-9, 2002.
- Program Committee member: International Workshop on Global and Peer-to-Peer Computing at IEEE International Symposium on Cluster Computing and the Grid (CCGrid'2002), Berlin, Germany, May 21-24, 2002.
- Program Committee member: 11th International World Wide Web Conference Honolulu, Hawaii, May 7-11, 2002.
- Program Committee member: 2nd Workshop on Privacy Enhancing Technologies San Francisco, CA, April 14-15, 2002.
- Program Committee member: The 1st International Workshop on Peer-to-Peer Systems (IPTPS'02) MIT Faculty Club, Cambridge, MA, March 7-8, 2002.
- Program Committee member: The 4th International Conference on Telecommunications and Electronic Commerce Dallas, TX, November, 2001.
- Program Committee member: 10th USENIX Security Symposium, Washington D.C., August 13-17, 2001.
- Program Committee member: Financial Cryptography '01 Grand Cayman, Cayman Islands, BWI, February, 2001.
- **Program Co-chair:** (w/Paul Van Oorschot): ISOC Symposium on Network and Distributed System Security, San Diego, CA, February 7-9, 2001.
- Program Committee member: The 3rd International Conference on Telecommunications and Electronic Commerce Dallas, TX, November 16-19, 2000.
- Program Committee member: 9th USENIX Security Symposium, Denver, Colorado, August 14-17, 2000.
- Program Committee member: Workshop on Design Issues in Anonymity and Unobservability Berkeley, California, July 25-26, 2000.
- Program Committee member: Performance and Architecture of Web Servers (PAWS), Santa Clara, CA, June 18, 2000.
- **Program Co-chair:** (w/Gene Tsudik): ISOC Symposium on Network and Distributed System Security, San Diego, CA, February 2-4, 2000.
- Program Committee member: 1999 International Information Security Workshop (ISW'99), Kuala Lumpur, Malaysia, November 6-7, 1999.
- Program Committee member: 2nd Int'l. Conference on Telecommunications and Electronic Commerce, Nashville, TN, October 6-8, 1999.
- Invited Talks coordinator: 8th USENIX Security Symposium, Washington D.C., August, 1999.
- **Program Chair:** 24th USENIX Annual Technical Conference, Monterey, CA, June 7-11, 1999.
- Program Committee member: 8th International World Wide Web Conference , Toronto, Canada, May 11-14, 1999.
- Program Committee member: 3rd USENIX workshop on Electronic Commerce , Boston, MA, August 31 - September 3, 1998.

- Program Committee member: 5th ACM Conference on Computer and Communications Security, San Francisco, CA, November 3-5, 1998.
- **Program Chair:** 7th USENIX Security Symposium, San Antonio, TX, Jan. 26-29, 1998.
- Program Committee member: 4th ACM Conference on Computer and Communications Security, Zurich, Switzerland, April 2-4, 1997.
- Program Committee member: 6th USENIX Security Symposium, San Jose, CA, July 22-25, 1996.
- Program Committee member: ISOC Symposium on Network and Distributed System Security, San Diego, CA, February 22-23, 1996.

- **Panels**
  - **Panelist:** CyberTech Global Conference: The Post-COVID Cyber Challenges in the Health Sector, UAE-Dubai (April 6, 2021).
  - **Panel Organizer and Moderator**: USENIX Security Conference: The 2020 Election: Remote Voting, Disinformation, and Audit (August 12, 2020).
  - **Panelist:** Cardozo Society Associated panel: Cybersecurity and Privacy Law in the Digital Era, Baltimore, MD (February 19, 2020).
  - **Panelist:** Washington Post panel: Hacking Health, Washington DC (June 14, 2016).
  - **Panelist:** Financial Cryptography Conference, Security & Privacy, Barbados (February 24, 2016).
  - **Panelist:** RSA Conference, Social Networks Security Panel, San Francisco, CA (April 21, 2015).
  - **Panelist:** Expert Witness in Mock Trial: FTC Data Security, 63rd American Bar Association Section of Antitrust Law Spring Meeting Washington DC, (April 15, 2015).
  - **Panelist:** Security in Electronic Medical Records Databases, Medicine 2.0 Workshop, Haifa, Israel, (April 7, 2011).
  - **Panelist:** Security in the Cloud, Workshop on Cloud Security, Israeli Defense Ministry, Tel Aviv, Israel, (February 15, 2011).
  - **Panelist:** Securing Information Technology in Healthcare (SITH), Security and Usability of Electronic Health Records, Dartmouth College, NH, (May 17, 2010).
  - **Panelist:** First Security and Privacy in Medical and Home-Care Systems Workshop (SPIMACS), Authentication in iHealthcare, Chicago, IL, (November 13, 2009).
  - **Panelist:** Computers, Freedom, and Privacy Conference, Internet Voting for Overseas Americans, Washington DC, (June 4, 2009).
  - **Panelist:** Workshop on Electronic Voting, Electronic Voting: Future Aspirations, Tel Aviv, Israel (May 18, 2009).
  - **Panelist:** RSA Conference, Exploiting Online Games, San Francisco, CA (April 23, 2009).
  - **Panelist:** American Association for the Advancement of Science, *Revisiting the U.S. Voting System: A Research Inventory, Technology, Usability, and Security panel*, Washington DC, (November 27, 2006).
  - **Panelist:** California Secretary of State's Voting System Testing Summit, *Security Panel*, Sacramento, CA, (November 28-29, 2005).
  - **Panelist:** NIST Symposium on Voting System Threats, *Configuration and Usability Threats*, Gaithersburg, MD, (October 7, 2005).
  - **Panelist:** Conference of State Supreme Court Chief Justices, *Voting Technologies*, Charleston, SC (August 1, 2005).
  - **Panelist:** *Workshop on observation of automated elections*, The Carter Center, Atlanta, GA (March 18, 2005).
  - **Panelist:** The Carter Center Venezuela Virtual Panel, (November, 2004).
  - **Panelist:** Workshop on Voting, *Vote Capture and Vote Counting*, Harvard Kennedy School of Government, The Technologies of Voting, Cambridge, MA (June 1, 2004).
  - **Panelist:** Computer Science and Telecommunications Board of The National Academy of Science *Workshop on Dependable Software Systems*, Case Study: Electronic Voting Washington D.C. (April 20, 2004).

- **Panelist:** USENIX Security 2003, *Electronic Voting*, Washington D.C. (August 6, 2003).
- **Panelist:** Democracy Now, 2003, *Voter-Verifiable Elections: How Do We Get There?*, Washington D.C. (November 23, 2003).
- **Panelist:** USENIX Security 2003, *Electronic Voting*, Washington D.C. (August 6, 2003).
- **Panelist:** IEEE Infocom 2002, *Securing Wireless and Mobile Networks - Is It Possible?*, New York City (June 25, 2002).
- **Participant:** 2002 Security Visionary Roundtable: *A Roadmap for a Safer Wireless World*, Washington D.C., (May 5-7,2002).
- **Panelist:** Computers Freedom and Privacy 2002, *Who Goes There? Privacy in Identity and Location Services*, San Francisco (April 18, 2002).
- **Panel moderator:** Conference on Democracy and the Internet in an Enlarging Europe *Overview of On-Line Voting: Systems and Issues*, New York, NY (March, 2001).
- **Panelist:** Financial Cryptography 2001, *The Business of Electronic Voting*, Grand Cayman (February, 2001).
- **Panelist:** National Science Foundation *E-voting workshop*, Washington, D.C., (October, 2000).
- **Panelist:** 5th ACM Conference on Computer and Communications Security, Anonymity on the Internet, San Francisco, CA, (November 1998).
- **Panelist:** Open Systems Security and ISSA Annual Conference, *Securing the Web*, Orlando, FL (March, 1998).
- **Panel organizer and moderator:** *Implementation Issues for Electronic Commerce: What Every Developer Should Know*. ISOC Symposium on Network and Distributed System Security, (March, 1998).
- **Panel organizer and moderator:** *Downloadable Executable Content - Past, Present and Future*. ISOC Symposium on Network and Distributed System Security (February, 1997).
- **Panelist:** DIMACS Workshop on Network Threats, Web/Java Security Issues, New Brunswick, NJ (December 5, 1996).

- **Tutorials Taught**
  - The Mathematics of Information Technology and Complex Systems Network (MITACS), *Network Security*, (May 8, 2003).
  - IEEE Infocom 2002, *End to End Web Security and E-commerce*, (June 23, 2002).
  - 2002 USENIX Annual Technical Conference, *Introduction to Computer Security*, (June 10, 2002).
  - LISA 2001, 15th Systems Administration Conference, *Introduction to Computer Security*, (December, 2001).
  - 8th & 9th USENIX Security Symposia, *Cryptography - From the Basics Through PKI in 23,400 Seconds*, (August, 2000) & (August 1999), with Dan Geer.
  - 9th International World Wide Web Conference, *Security on the World Wide Web*, (May, 2000).
  - ISOC Symposium on Network and Distributed System Security, *Cryptography 101*, (February, 2000).

Testimony

Before Government Bodies

- United Stated House Committee on Administration, Full Committee Hearing - Exploring the Feasibility and Security of Technology to Conduct Remote Voting in the House, Live via WebEx, (July 17, 2020).
- Maryland House, Expert Testimony, Hearing on HB 888, Consumer Protection - Security Features for Connected Devices, *Economic Matters Committee,* Annapolis, MD, (February 26, 2020).

- Maryland Senate, Expert Testimony, Hearing on SB 443 Security Features for Connected Devices, *Finance Committee,* Annapolis, MD, (February 19, 2020).
- Maryland Senate, Expert Testimony, Hearing on SB 553/HB 1276 Security Features for Connected Devices, *Finance Committee,* Annapolis, MD, (February 26, 2019).
- United States Pentagon, High Level Security Briefing on the Security of Embedded Devices (January 15, 2014).
- United Stated House Committee on Science, Space, and Technology, *Full Committee Hearing - Is My Data on Healthcare.gov Secure?*, Washington, D.C., (November 19, 2013).
- United Stated House Committee on Oversight and Government Reform, *hearing on electronic voting*, Washington, D.C., (April 18, 2007).
- United Stated House Committee on Appropriations, *hearing on ensuring the integrity of elections*, Washington, D.C., (March 7, 2007).
- Maryland Senate Committee on Education, Health, and Environmental Affairs, Expert Testimony, *Hearing on Senate Bill 392 for Voter-Verified Records in Voting Systems*, Annapolis, MD, (February 22, 2007).
- Maryland House Ways and Means Committee, Expert Testimony, *Hearing on House Bill 18 for improving voting systems in Maryland*, Annapolis, MD, (February 1, 2007).
- Maryland House Ways and Means Committee, Expert Testimony, *Hearing on House Bill 244 requiring a voter verified paper record for voting machines in Maryland*, Annapolis, MD, (February 1, 2006).
- United States Election Assistance Commission, *Hearing on Voluntary Voting Systems Guidelines*, Expert Testimony, Panel on Voter Verified Paper Audit Trail, Washington D.C. (June 30, 2005).
- Senate hearing: *Voting in 2004: A Report to the Nation on America's Election Process*, Expert Testimony, Absentee Ballot Panel, Dirksen Senate Office Building, Washington, DC (December 7, 2004).
- United States Election Assistance Commission, Technical Guidelines Development Committee, Technology Panel, Expert Testimony, *Public Hearings on Computer Security and Transparency*, National Institute of Standards and Technology, Gaithersburg, MD, (September 20, 2004).
- United States House Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census, Expert Testimony, *Hearing on Electronic Voting*, Washington, D.C. (July 20, 2004).
- United States House Committee on House Administration, Expert Testimony, *Hearing on Security of Electronic Voting*, Washington, D.C. (July 7, 2004).
- United States Federal Trade Commission, Written Expert Testimony, on a proposed Do Not Email Repository, (May 10, 2004).
- United States Election Assistance Commission, Expert Testimony, *Hearing on Electronic Voting Security*, Technology Panel, Washington D.C. (May 5, 2004).

As an Expert in Litigation

- **IOEngine, LLC,** vs. Ingenico Inc., Case # 1:18-cv-826 WCB; Dechert LLP, United States District Court, District of Delaware. (*Patent Infringement & Patent Validity)*
  - Expert Testimony at trial, Wilmington, DE (July 12 & 14, 2022).
  - Expert Testimony at deposition, Annapolis, MD (January 28, 2022).
  - Expert Testimony at deposition, Bonita Springs, FL (January 19, 2022).
- **WSOU Investments, LLC,** vs. Microsoft Corporation, Case # 6:20-cv-00464-ADA; Susman Godfrey, United States District Court, Western District of Texas. (*Patent Infringement and Patent Validity)*
  - Expert Testimony at deposition, Annapolis, MD (May 15 & 16, 2022).
- **10Tales Inc.** vs. TikTok PTE. LTD., Case # 4:21-cv-3868-YGR; Cozen O'Connor, United States District Court, Northern District of California. (*Patent Claim Construction)*
  - Expert Testimony at deposition, Annapolis, MD (May 11, 2022).
- **IOEngine, LLC,** vs. PayPal Holdings, Inc., Case # 1:18-cv-452 WCB; Dechert LLP, United States District Court, District of Delaware. (*Patent infringement)*
  - Expert Testimony at deposition, Bonita Springs, FL (January 18, 2022).
  - Expert Testimony at deposition, Bonita Springs, FL (January 26, 2022).

- AGIS Software Development LLC vs. **Uber Technologies Inc.**, Case # 2:21-cv-00026-JRG-RSP, Gibson Dunn, United States District Court, Eastern District of Texas. (*Non-infringement)*
  - Expert Testimony at Deposition, Annapolis, MD (December 22, 2021).
- Sable Networks vs. **Splunk Inc.**, Case # 5:21-CV-00040-RWS, Morrison and Foerster, United States District Court, Eastern District of Texas. (*Claim Construction)*
  - Expert Testimony at Deposition, Annapolis, MD (December 13, 2021).
- Finjan vs. **Palo Alto Networks**, Case # 4:14-CV-04908-PJH, Morrison and Foerster, United States District Court, Northern District of California. (*Claim Construction)*
  - Expert Testimony at Deposition, Pikesville, MD (August 16, 2021).
- Huawei Technologies Co. vs. **Verizon Communications Inc.**, Case # 6:20-CV-00090, Quinn Emanuel, United States District Court, Western District of Texas. (*Patent non-infringement and patent invalidity)*
  - Expert Testimony at Deposition, Pikesville, MD (July 1, 2021).
- Epic Games, Inv vs. **Apple Inc.**, Case # 4:20-cv-05640-YGR-TSH, Gibson Dunn, United States District Court, Northern District of California. (*Sherman Act)*
  - Expert Testimony at Trial, Oakland, CA (May 20-21, 2021).
  - Expert Testimony at Deposition, Pikesville, MD (March 26, 2021).
- Philips North America LLC ; Koninklujke Philips N.V. vs. **Summit Imaging Inc.**, Case # 2:19-cv-01745-JLR, Seed IP, United States District Court, Western District of Washington at Seattle. (*DMCA and Copyright)*
  - Expert Testimony at deposition, Pikesville, MD (March 16, 2021).
- **California Physicians Service, Inc D/B/A Blue Shield of California** vs. Healthplan Services Inc, Case # 3:18-cv-3730 Latham & Watkins, United States District Court, Northern District of California. (*Contract Dispute: Software Quality and Security)*
  - Expert Testimony at Deposiiton, Pikesville, MD (March 9, 2021).
- Finjan vs. **Qualys Inc.**, Case # 4:18-cv-07229-YGR, Wilson Sonsini, United States District Court, Northern District of California. (*patent invalidity and non-infringement)*
  - Expert Testimony at Deposition, Pikesville, MD (March 4, 2021).
- Finjan vs. **Sonicwall Inc.**, Case # 5:17-cv-04467-BLF-HRL, Duane Morris, United States District Court, Northern District of California. (*patent invalidity and non-infringement)*
  - Expert Testimony at deposition, Pikesville, MD (October 30, 2020).
  - Expert Testimony at deposition, Pikesville, MD (October 29, 2020).
- **TecSec Inc** vs. Cisco, Case # 1:10-CV 115 LO-TCB; Hunton & Williams, United States District Court, Eastern District of Virginia. (*Patent Infringement, Patent Validity)*
  - Expert Testimony at deposition, Annapolis, MD (September 14, 2020).
- **TecSec Inc** vs. Oracle, Case # 1:10-CV 115 LO-TCB; Hunton & Williams, United States District Court, Eastern District of Virginia. (*Patent Infringement, Patent Validity)*
  - Expert Testimony at deposition, Annapolis, MD (September 11, 2020).
- **Blackberry Limited** vs. Facebook, Inc, Case #2:18-cv-01844 (KSx), Quinn Emanuel Urquhart & Sullivan, LLP, United States District Court, Central District of California.
  -Expert Testimony at Deposition, Baltimore, MD (December 20, 2019). (*patent infringement & patent validity*)
- **Netfuel, Inc**. vs. Cisco Systems, Inc, Case # 5:18-cv-2352-EJD, Susman Godfrey, United States District Court, Northern District of California.
  -Expert Testimony at Deposition, Baltimore, MD (December 16 & 17, 2019). (*patent infringement & patent validity*)
  -Expert Testimony at Deposition, Baltimore, MD (June 11, 2019). (*patent infringement*)
  -Expert Testimony at Markman Hearing, San Jose, CA (February 28, 2019). (*courtroom tutorial*)
  -Expert Testimony at deposition, Baltimore, MD (December 20, 2018). (*claim construction*)
- **Symantec Corporation** vs. Zscaler, Inc., Case # 3:17-CV-04414-JST, Baker Botts, United States District Court, Northern District of California.
  -Expert Testimony at Deposition, Baltimore, MD (December 6, 2019). (*patent infringement*)
  -Expert Testimony at Deposition, Baltimore, MD (August 2, 2019). (*Assignor Estoppel*)

- Koninklijke Philips vs. **Microsoft Inc**, Case # 4:18-cv-01885-HSG, Perkins Coie, United States District Court, Northern District of California. (*patent non-infringement and patent invalidity*)
  -Expert Testimony at Deposition, Baltimore, MD (July 17, 2019).
- **Cypress Lake Software, Inc**. vs. Samsung Electronics & Dell Inc, Case # 6:18-cv-030-JKD and 6:18-cv-0138-JDK, Garteiser Honea, United States District Court, Eastern District of Texas. (*patent infringement and patent validity*)
  -Expert Testimony at Deposition, Baltimore, MD (July 10-11, 2019).
- Finjan vs. **Juniper Networks**, Case # 3:17-cv-05659-WHA , Irell and Manella, United States District Court, Northern District of California.
  -Expert Testimony at deposition, Baltimore, MD (April 2, 2019). (*patent non-infringement)*
  -Expert Testimony at deposition, San Francisco, CA (March 9, 2019). (*patent non-infringement)*
  -Expert Testimony at trial, San Francisco, CA (December 13, 2018). (patent non-infringement and invalidity)
  -Expert Testimony at deposition, Baltimore, MD (November 9, 2018). (patent non-infringement and invalidity)
  -Expert Testimony at deposition, Baltimore, MD (July 6, 2018). (*patent non-infringement)*
  -Expert Testimony at deposition, Baltimore, MD (June 12, 2018). (*patent non-infringement)*
- Grace et. al. vs. **Apple Inc.**, Case # 5:17-CV-00551-LHK (NC), Durie Tangri, United States District Court, Northern District of California. (*class action)*
  -Expert Testimony at deposition, Towson, MD (September 26, 2018).
- **Rimini Street, Inc**. vs. Oracle International Corporation, et. al., Case # 2:14-CV-01699 LRH-CWH, Gibson Dunn, United States District Court, District of Nevada. (*Software security*)
  -Expert Testimony at deposition, Baltimore, MD (August 30, 2018).
- Grace et. al. vs. **Apple Inc.**, Case # 5:17-CV-00551-LHK (NC), Kirkland & Ellis, United States District Court, Northern District of California. (*class certification)*
  -Expert Testimony at deposition, Pikesville, MD (July 3, 2018).
- **F5 Networks, Inc.** vs. Radware, LTD., IPR 2017-00124, Perkins Coie, US Patent Trial and Appeal Board. (*patent Invalidity)*
  -Expert Testimony at deposition, Baltimore, MD (January 24, 2018).
- **Amazon.com Inc., Hulu, LLC, and Netflix, Inc,** vs. Uniloc Luxembourg S.A., IPR 2017-00948, Perkins Coie, US Patent Trial and Appeal Board. (*patent Invalidity)*
  -Expert Testimony at deposition, Baltimore, MD (October 9, 2017).
- Phishme, Inc. vs. **Wombat Technologies, Inc**, Case # 16-403-LPS-CJB, K&L Gates, United States District Court, Delaware. (*patent claim construction)*
  -Expert Testimony at deposition, Washington DC, (October 5, 2017).
- Finjan vs. **Symantec Corporation.**, Case # 14-cv-02998-HSG, Quinn Emanuel, United States District Court, Northern District of California. (*patent invalidity and non-infringement)*
  -Expert Testimony at deposition, Baltimore, MD (September 14-15, 2017).
- **Kudelski SA, Nagra USA, Inc., Nagravision SA, and OpenTV, Inc.** vs. Comcast Corporation, Case # 2:16-cv-1362-JRG, Covington, United States District Court, Eastern District of Texas. (*patent claim construction).*
  -Expert Testimony at deposition, Baltimore, MD (September 1, 2017).
- **F5 Networks, Inc.** vs. Radware, LTD., IPR 2017-00124, Perkins Coie, US Patent Trial and Appeal Board. (*patent Invalidity)*
  -Expert Testimony at deposition, Baltimore, MD (August 10, 2017).
- Intellectual Ventures vs. **JP Morgan Chase & Co.**, Case # 1:13-cv-03777, Kirkland & Ellis, United States District Court, Southern District of New York. (*Patent non-infringement).*
  -Expert Testimony at deposition, Baltimore, MD (June 1, 2017).
- Nader Asghari-Kamrani and Kamran Asghari-Kamrani vs. **United Services Automobile Association**. Case # 2:15-CV-478, Fish & Richardson, United States District Court,

Eastern District of Virginia. (*Patent Written Description Support related to Inequitable Conduct).*

-Expert Testimony at trial, Norfolk, VA (April 21, 2017).

-Expert Testimony at deposition, Baltimore, MD (March 21, 2017).

- **Sabre GLBL Inc,** vs. HP Enterprise Services LLC. Case # 1310022761, JAMS Binding Arbitration Hearing, Dallas, TX (*Contract dispute*).

-Expert Testimony at arbitration hearing, Dallas, TX (April 5, 2017).

- **Al Cioffi et. al.** vs. Google, Case # 2:13-cv-103-JRG-RSP, Vasquez, Benisek & Lindgren, United States District Court, Eastern District of Texas. (*patent Infringement).*

-Expert Testimony at trial, Marshall, TX (February 7, 2016).

-Expert Testimony at deposition, Baltimore, MD (September 26, 2016).

- **Palo Alto Networks** vs. Finjan, IPR 2015-01979, Cooley, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (November 14, 2016).

- **Palo Alto Networks** vs. Finjan, IPR 2016-00151, Morrison & Foerster, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (August 19, 2016).

- **Palo Alto Networks** vs. Finjan, IPR 2015-01974, Cooley, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (August 2, 2016).

- **Palo Alto Networks** vs. Finjan, IPR 2015-02001 & IPR 2016-00157, Cooley, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (July 26 & 27, 2016).

- **Amazon.com, Inc** vs. Zitovault, LLC, IPR 2016-00021, Perkins Coie, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (July 22, 2016).

- **Palo Alto Networks** vs. Finjan, IPR 2015-01979, Cooley, US Patent Trial and Appeal Board. (*patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (May 20, 2016).

- Vir2us Inc. v. **Invincea, Inc. and Invincea Labs, LLC**, Case # 2:15cvl62; Cooley, United States District Court, Eastern District of Virginia. (*Patent Non-Infringement and Invalidity)*

-Expert Testimony at deposition, Reston, VA (April 20, 2016).

- TVIIM. v. **McAfee Inc.**, Case # 3:13-cv-04545-VC; Wilmer Hale, United States District Court, District of N. California. (*Patent Non-Infringement and Invalidity)*

-Expert Testimony at trial, San Francisco, CA (July, 2015).

-Expert Testimony at deposition, Baltimore, MD (February, 2015).

- Intellectual Ventures vs. **Symantec**, Case # 1:10-cv-01067-LPS; Latham & Watkins, United States District Court, District of Delaware. (*Patent Invalidity)*

-Expert Testimony at trial, Wilmington, DE (February, 2015).

-Expert Testimony at deposition, Baltimore, MD (May, 2013).

- **Rovi Solutions & Veracode** vs. Appthority, Case # 12-10487-DPW; Goodwin Procter, United States District Court, District of Massachusetts. (*Patent Infringement and Validity)*

-Expert Testimony at trial, Boston, MA (August 11, 2014).

-Expert Testimony at deposition, Baltimore, MD (April 4, 2014).

- **Juniper** vs. Palo Alto Networks, Case # 1:11-CV-01258-SLR; Irell & Manella, United States District Court, District of Delaware. (*Patent Infringement*)

-Expert Testimony at trial, Wilmington, DE (February, 2014).

-Expert Testimony in court hearing, Wilmington, DE (November 14, 2013).

-Expert Testimony at deposition, Baltimore, MD (June, 2013).

- Prism Technologies. v. **Adobe Systems Inc**., Case # 8:10-cv-00220-LES-TDT; DLA Piper, United States District Court, District of Nebraska. (*Patent Invalidity)*

-Expert Testimony at deposition, Baltimore, MD (August, 2012).

- Finjan Inc. vs. **McAfee, Inc**., Case # 10-593 (GSM), Kirkland & Ellis, United States District Court, District of Delaware. (*Patent Non-Infringement)*

-Expert Testimony at deposition, Washington, DC (June, 2012).

- Avaya Inc. vs. **Telecom Labs Inc,. TeamTLI.com Corp., and Continuant Technologies**, Case # 3:06-cv-02490 (GEB); K&L Gates, United States District Court, District of New

Jersey. (*Contract Dispute)*
  - Expert Testimony at deposition, Newark, NJ (August, 2011).
- **Lear Automotive** vs. Johnson Controls Inc (JCI), Case # 04-CV-73461; Flachsbart & Greenspoon, United States District Court, Eastern District of Michigan. (*Patent Infringement and Validity)*
  - Expert Testimony at trial, Detroit, MI (February, 2011).
  - Expert Testimony at deposition, Baltimore, MD (December, 2005).
- **TecSec Inc** vs. International Business Machines Corporation, Case # 1:10-CV 115 LMB/TCB; Hunton & Williams, United States District Court, Eastern District of Virginia. (*Patent Infringement)*
  - Expert Testimony at deposition, Newark, NJ (November, 2010).
- **Echostar Satellite Corporation** vs. NDS Group, Case # SA CV 03-950 DOC(JTL); T. Wade Welch & Associates, United States District Court, Central District of California. (*Copyright and DMCA)*
  - Expert Testimony at trial, Santa Ana, CA (April, 2008).
  - Expert Testimony at deposition, Santa Ana, CA (April, 2008).
  - Expert Testimony at deposition, Baltimore, MD (October, 2007).
- **Web.com Inc** vs. The Go Daddy Group Inc., Case # CV07-01552-PHX-MHM; Graves Law Office, United States District Court, Arizona. (*Patent Infringement*)
  - Expert Testimony at Markman hearing, Phoenix, Az (July, 2008).
  - Expert Testimony at deposition, Baltimore, MD (May, 2008).
- z4 Technologies vs. **Microsoft & Autodesk**, Case # 2:04-CV-00335-LED; Fish & Richardson, United States District Court, Eastern District of Texas. (*Patent Non-Infringement and Invalidity)*
  - Expert Testimony at trial, Tyler, TX, (April, 2006).
  - Expert Testimony at deposition, Washington DC (January, 2006).
- **Linda Schade** vs. Linda Lamone et. al., *Trial on the Legality of Paperless Voting Machines in Maryland*. (*Adequacy of Voting Equipment)*
  - Expert Testimony at trial, Annapolis, MD (August 25, 2004).

Awards

- 2020, **Best Paper Award,** in the category of Mobile & Wireless Computing, 11th IEEE Annual Ubiquitous Computing, Electronics, and Mobile Communications Conference (UEMCON), October, 2020.
- 2020, **Best Paper Award,** in the category of Image Processing & Multimedia Technology, 11th IEEE Annual Ubiquitous Computing, Electronics, and Mobile Communications Conference (UEMCON), October, 2020.
- IEEE Computer Society Technical Committee on Security and Privacy, **Distinguished Service Award**, May, 2020.
- **Fulbright Scholar** in Israel at Tel Aviv University, academic year 2010-2011.
- 2009, **Google Research Award**, *Securing Medical Records on Smartphones.*
- Chosen as one of **54 favorite people, places and things in Jewish Baltimore**, Baltimore Jewish Times, February 22, 2008.
- 2007 Award for Outstanding Research in Privacy Enhancing Technologies, for *Security Analysis of a Cryptographically-Enabled RFID Device* (with Stephen C. Bono, Matthew Green, Ari Juels, Adam Stubblefield, Michael Szydlo).
- 2005 **Best Student Paper Award** at the 14th USENIX Security Symposium, *Security Analysis of a Cryptographically-Enabled RFID Device* (with Stephen C. Bono, Matthew Green, Ari Juels, Adam Stubblefield, Michael Szydlo).
- 2004 **Electronic Frontiers Foundation** *Pioneer Award*.
- **Baltimorean of the Year**, Baltimore Magazine, January, 2004.
- 2001 **Index on Censorship** *Freedom of Expression Award* for the Best Circumvention of Censorship for the Publius project.
- 2000 **Best Paper Award** at the 9th USENIX Security Symposium, *A robust, tamper-evident and censorship-resistant web publishing system* (with Marc Waldman and Lorrie Cranor).

- 1999 **Best Paper Award & Best Student Paper Award** at the 8th USENIX Security Symposium, *The Design and Analysis of Graphical Passwords* (with Ian Jermyn, Alain Mayer, Fabian Monrose, and Michael K. Reiter).
- 1996 Co-author of **Best Student Paper**, *Building Systems that Flexibly Control Downloaded Executable Content*, at the 6th USENIX UNIX Security Symposium. Student: Trent Jaeger.
- 1992 National Science Foundation Fellowship - Summer Institute in Japan
- 1986 Branstrom Prize, University of Michigan

Technical Advisory Boards

Current Positions

- Qualytics
  - Data Quality Assurance
- RunSafe
  - Binary rewriting to protect software
- ZeroFox
  - Provide security for social networking
- Snag-A-Slip
  - Online boat slip bookings

Past Successful Technical Advisory Board Positions

- Arbor Networks
  - Acquired by Danaher, August, 2010.
- Authentica
  - Acquired by EMC Corporation, March, 2006.
- Fortify Software
  - Acquired by Hewlett Packard, September 2010.
- Gilian Technologies
  - Acquired by Breach Security, Inc, July, 2004.
- Hx Technologies
  - Acquired by MEDecision, May, 2009.
- Indigo Security
  - Acquired by Tablus, February, 2005.
- NeoPath Networks
  - Acquired by Cisco, April, 2007.
- Netscaler
  - Acquired Citrix Systems, August, 2005.
- SiteAdvisor
  - Acquired by McAfee, April, 2006.
- Tablus
  - Acquired by EMC Corporation, August, 2007.

APPENDIX B

UNDERWRITING SOLUTIONS

Underwriting Risk Ranking | Agency Risk Ranking |
Underwriting Loss Projection | Underwriting Premium Targeting |
Underwriting Loss Ratio Targeting | At-Risk Renewals |
Workers' Comp-Specific Underwriting |
Group Benefits Underwriting

With Gradient AI, insurers enhance their underwriting capabilities by gaining a more complete, in-depth picture of risk, enabling them to recognize good risks that others miss and pricing them more aggressively.

ratios

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- **Accelerate expansion** into a new geography, new line of business or a new industry sector, leveraging data to gain a deeper understanding of risk in new markets

missed, and price accordingly, or decline the business depending on strategic priorities.

Underwriting Risk Ranking

Gradient's Underwriting Risk Ranking solution predicts the likelihood of claims on each individual application and provides an assessment of risk that your organization can present to underwriters for decision support or incorporated into automated processes to streamline quoting.

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Agency Risk Ranking

Gradient's Agency Risk Ranking solution for agents and brokers predicts the likelihood of claims on each individual application and provides an assessment of risk that captive and independent agents, and brokers, can use to determine suitability of an individual client for a particular insurance program. This prediction can also be used to power automated processes to streamline quoting.

Underwriting Loss Projection

maintaining loss ratio and profitability for each policy and across your organization's entire book.

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Underwriting Premium Targeting

Gradient's Underwriting Premium Targeting solution provides recommended premium amounts for both new business applications and renewals. The recommended premiums can be calibrated to achieve a target loss ratio at either the policy or portfolio level.

Underwriting Loss Ratio Targeting

Gradient's Underwriting Loss Ratio Targeting solution assigns a relative risk score to each application. This risk score can be used to avoid or appropriately price applications that present the greatest risk, and to streamline quoting of applications that present the least risk, all while modeling the impact of those decisions on your top and bottom lines.

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organization can take proactive steps to avoid losing your best customers.

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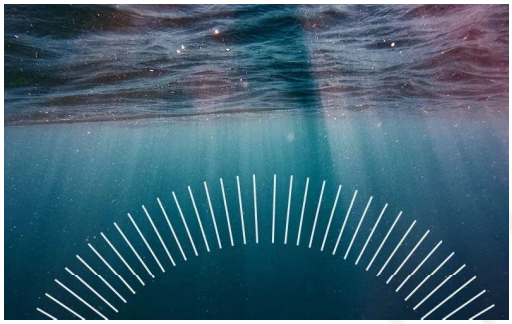
Workers' Comp-Specific Underwriting



Payroll Class Codes

Gradient's Payroll Reclassification model predicts the likelihood of an increase or decrease in premium after an audit. The solution also predicts a likelihood that the governing class code is correct, other likely governing class codes, and potentially

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Group Benefits Underwriting

SAIL | PHQ Underwriting | Group Health Manual Rating Scores | Group Health Renewal | Group Health Renewal Reporting | Group Health At-Risk Renewals

Allied National Streamlines Small Group Business Underwriting with Gradient AI

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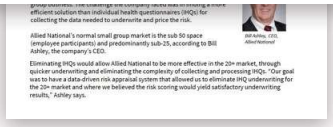

SAIL™

Gradient's SAIL™ group health underwriting solution evaluates the potential cost of each submission and provides predictions that clients can incorporate into automated underwriting processes or use internally for underwriting and pricing decision support. SAIL™ uses anonymized prescription and medical claims data on the submitted population to inform its predictions.

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Gradient's PHQ Underwriting group health solution uses personal health questionnaires (PHQ) to evaluate the potential cost for each employee by analyzing disclosed conditions against our claim database and projecting each member's claim spend. The predicted costs are then aggregated to calculate the total group's projected cost and use it to score the risk.

Group Health Manual Rating

organizations), associations, MEWAs (multiple employer welfare arrangements), health insurance carriers, MGUs (managing general underwriters), brokers and large self-insured companies to determine the appropriate price for group health benefits and stop loss contracts.

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Group Health Renewal

Gradient's Group Health Renewal underwriting solution provides risk score predictions valuable for the renewal underwriting or repricing a block of business. Gradient's renewal underwriting models are tuned specifically to the

Group Health Renewal and Claims Analytics Reporting

Gradient's Group Health Renewal Reporting suite provides premium, claims and enrollment analytics in addition to predictive modeling results. Claims and analytics are updated monthly or quarterly, depending on frequency of data feeds available.

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Group Health Underwriting Submission Portal

Gradient's Group Health Underwriting Submission Portal streamlines the collection of census files, health questionnaires, and group questionnaires in near real-time, through an intuitive, Web-based tool. All supporting quote documentation is automatically stored, and all activity is tracked to ensure complete transparency.

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